Space Weather Technical Forecast

Issued on Thursday, 26 October 2023 at 01:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with a number of C-flares in the past 24hrs, the largest a C4.2, peaking at 25/0001 UTC from an area of plage rotating over the NE limb. There are currently just two small and relatively simple sunspots on the visible disc. AR3471 remains the most developmental although any growth appears the have peaked for now, with this bipolar region remaining small and rather simple. AR3468 persists as a small mature unipolar spot. There are also some small pores evident amongst the plage on the northeast disc.

No Earth-directed CMEs have been observed, although there have been some faint CMEs evident in coronagraph imagery from limb or far sided sources.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, remained indicative of a slow wind environment with background speeds, in the range 300-350km/s. Density was mostly average to below average but rose just above for a time in the UTC afternoon and evening, peak around 14ppcc. Interplanetary Magnetic Field (IMF), Bt, was weak, below 7nT, with its north-south component, Bz, ranging between +2 and -5nT, and becoming a little more variable in the second half of the period. Phi angle was negative (towards the Sun) until 25/1030 UTC, then switched to several temporary periods of positive (away from the Sun) orientation. Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux was mainly background, briefly reaching Moderate with peak 292 pfu at 25/1830 UTC. Associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold. The observation at 26/0000UTC was 7.24e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity forecast with occasional C-Class flares. There is a slight chance of M-flares, with the main risk currently from AR3471 just west of the southern centre disc.

Solar Wind / Geomagnetic Activity: There are currently no Earth-directed CMEs.

Background solar winds are expected to become briefly enhanced by the arrival of the fast winds of CH64/+, most likely on day 2 (27 Oct). Any enhancement is expected to be minimal with winds likely peaking around 450 km/s, before easing day 3 (28 Oct). The next potential enhancement from fast winds, from CH65/+ and CH66/+, could arrive late on day 4 (29th), but more likely into 30th.

Geomagnetic activity is forecast to be mainly Quiet, rising to Unsettled with Active spells possible with any fast wind onset day 3 (27 Oct). Activity could then become elevated by the end

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of day 4 (29th) with a slight chance of reaching G1/Minor Storm level, should CH65/+ and CH66/+ become geo-effective. However, this is low confidence.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at Background. High energy electron flux (greater than 2MeV) is expected to persist at Background with brief diurnal rises to Moderate possible. The associated 24 hour fluence is forecast to remain below the Active threshold (1e8 integrated pfu).

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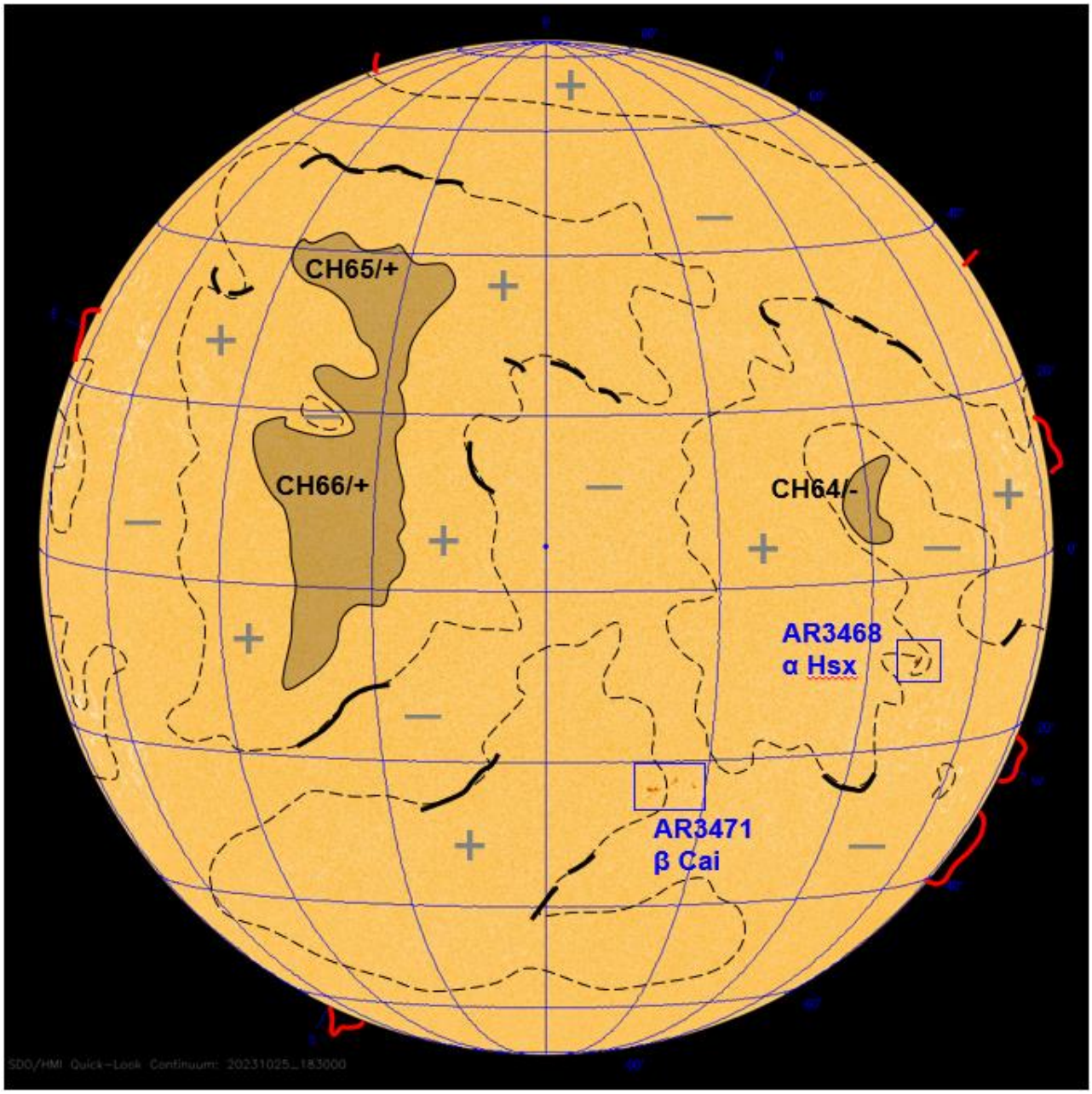
Figure 1. Solar Analysis Valid 25/1900UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:
There are no Earth-directed CMEs at present. There are a number of long filaments visible on the Earth-facing side of the Sun which will need to be watched, as any eruptions have the potential for Earth-directed components.

Background solar winds are expected day 1 (26 Oct). A transition into a weak fast wind is then likely day 2 (27 Oct), from CH64/-, currently situated in the northwest, just north of the Suns equator however, only a limited enhancement is expected, to around 450 km/s. Conversely MOSWOC Enlil suggests a strong fast wind onset albeit with a slightly later arrival time. This appears to either be an overestimation of the fast winds of CH65/+ and CH66/+ (which are not expected until at least at the end of this forecast period at the earliest), or potentially due to a non-existent central disc coronal hole that is currently within the initial conditions of the model (the PFSS) due to differences with the solar disc between the current and previous Carrington rotation. Any fast wind onset from CH64/- is likely to ease day 3 (28 Oct). The next potential fast wind (from the already mentioned CH65/+ and CH66/+) could arrive late on day 4 (29th), but more likely into 30th.

Mainly Quiet geomagnetic activity at first, rising to Unsettled, with isolated Active intervals possible day 2 (27 Oct) from any enhancement from CH64/- fast winds. Activity easing day 3 (28 Oct) to mainly Quiet, with isolated Unsettled spells. Activity could then become elevated by the end of day 4 (29th) with a slight chance of reaching G1/Minor Storm level, should CH65/+ and CH66/+ become geo-effective. However, this is low confidence.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	5	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

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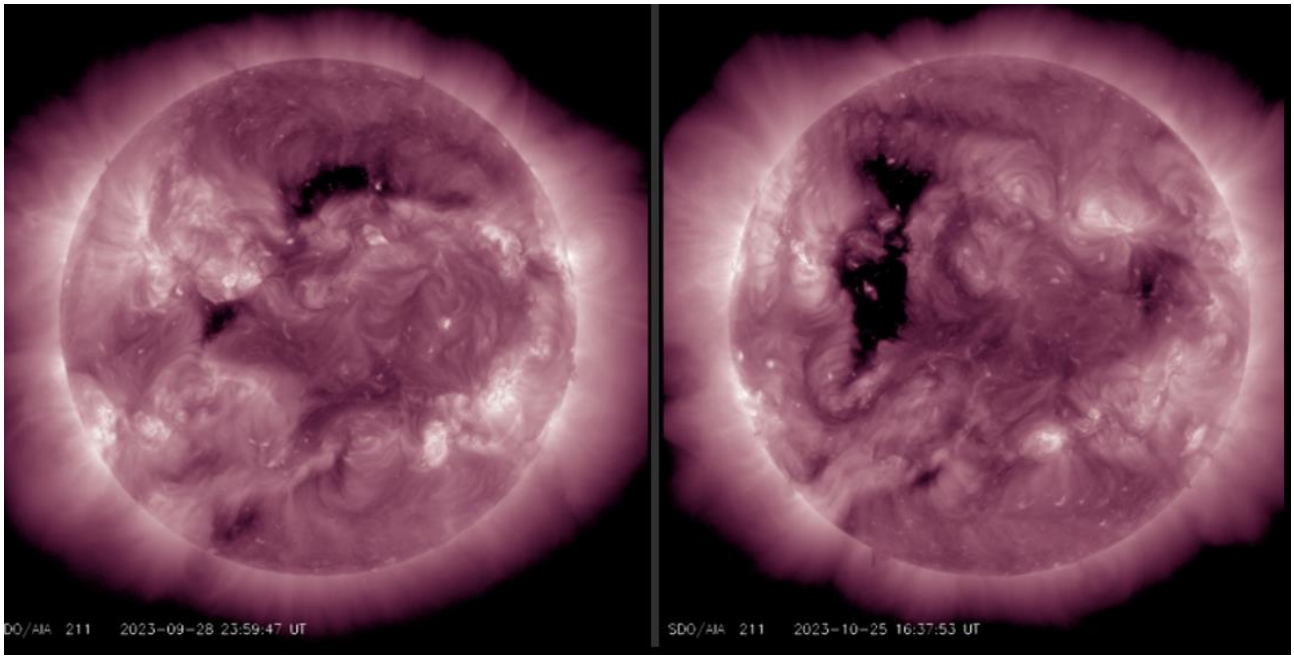
Figure 2: SDO/AIA 211 images of current and previous rotation, showing differences in coronal hole structures.



Radio Blackouts - X-Ray Flares:

Low activity is expected with only a slight chance of M-flares, mainly from AR3471.
The recent lull in solar activity continues. There are currently two small and relatively simple sunspots on the disc. AR3471 remains the most developmental although any growth appears the have peaked for now, with the region remaining small and rather simple however. AR3468 persists as a small mature unipolar spot. There are some small pore features amongst the plage on the northeast disc, however further development would be required for these to be confirmed as spot regions.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	15	20
Very Active	R3 to R5 X Class	No	1	1	1	1

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Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels in the absence of significant sunspot regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

Electron flux observed by GOES16 at GEO is currently at Background levels with only slight diurnal rises to Moderate expected. No significant increase to electron populations through the Van Allen Belt is expected during this period with only a weak coronal hole enhancement forecast on day 2 (27 Oct) due to CH64/-. The following CH65/+ and CH66/+ may begin to become geo-effective by the end of Day 4 (29th). These coronal holes look much larger and stronger features on imagery and are anticipated to have a more significant impact on electron populations once their associated fast winds become established. However, this is expected to be beyond the current forecast period.

The associated 24hr electron fluence is forecast to remain below the Active level. This is supported by REFM, while persistence provides a poor guide due to the arrival of CMEs on the previous rotation.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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